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Urban Stream Syndrome and the Presence of E. coli in Philadelphia Streams

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Urban Stream Syndrome and the Presence of *E. coli* in Philadelphia Streams

Eileen Black, La Salle University Honors Program



Abstract

In this experiment, water samples were collected from the Pennypack and Wissahickon Creeks as part of an exploratory study on the presence of microbes, particularly *Escherichia coli*, in urban streams. Contamination by *E. coli* may indicate that a creek is polluted and suffering from urban stream syndrome. *E. coli* was found in both creeks, likely due to their locations near a sewage treatment facility and a farm.

Introduction

- ❖ *E. coli* are rod-shaped, Gram-negative bacteria that can be discharged into the environment through fecal matter and wastewater.³
- ❖ The Wissahickon Creek is a tributary of the Schuylkill River that runs through northeastern Philadelphia.² The Pennypack Creek is a tributary of the Delaware River that runs through northeastern Philadelphia and other suburban counties.¹
- ❖ Creeks in the Philadelphia area are vulnerable to "urban stream syndrome," an environmental condition defined by "ecological degradation" as a result of urbanization. Symptoms of urban stream syndrome include "elevated concentrations of... contaminants," and "reduced biotic richness."⁷
- ❖ Urbanization can lead to an increase in pollutants discharged into urban streams, which may increase the presence of harmful pathogenic microbes like *E. coli*.^{4,6}
- ❖ Research on the ecology of urban systems can provide evidence of how environmental changes due to urbanization and pollution can affect ecosystem processes.⁵

Methods

- ❖ Water samples were collected from the Wissahickon Creek and the Pennypack Creek in urban areas from September 2019 until November 2019 (Fig. 3).
- ❖ 50µl of each water sample was plated on tryptic soy agar (TSA) (Figs. 4 & 5) and CHROMagar (CA) (Fig. 6).
- ❖ Samples suspected to be *E. coli* were spread on eosin methylene blue (EMB) agar plates, which appears metallic green when in contact with *E. coli* (Fig. 7).

Results & Discussion

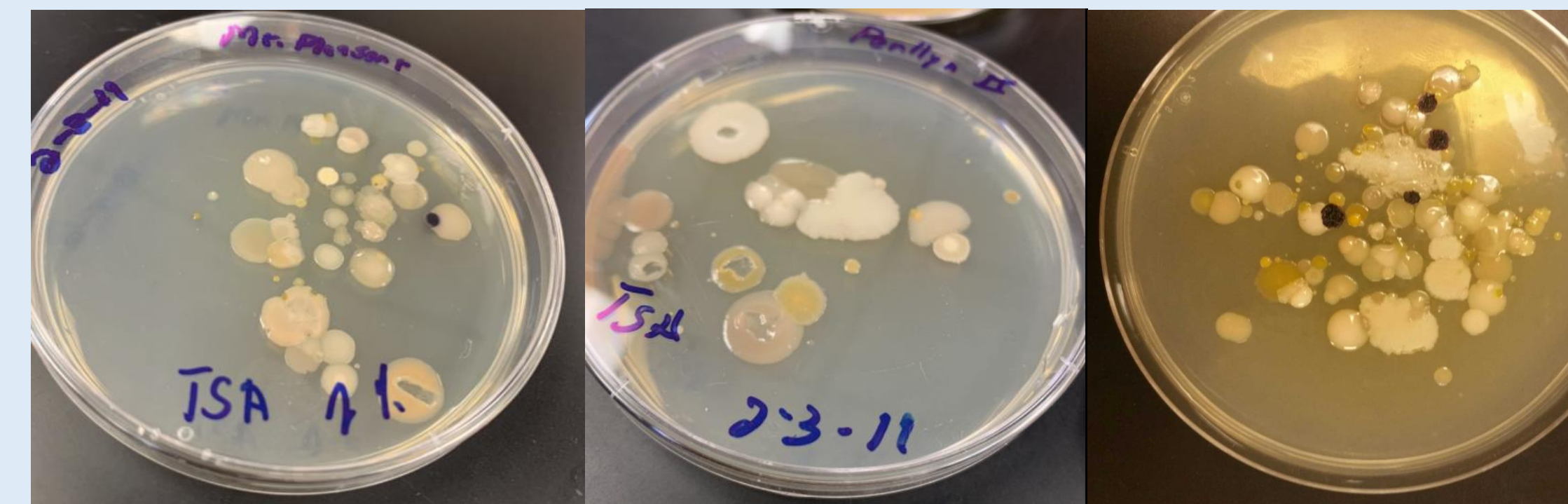


Figure 1: TSA plates of Wissahickon water samples collected in February 2019.

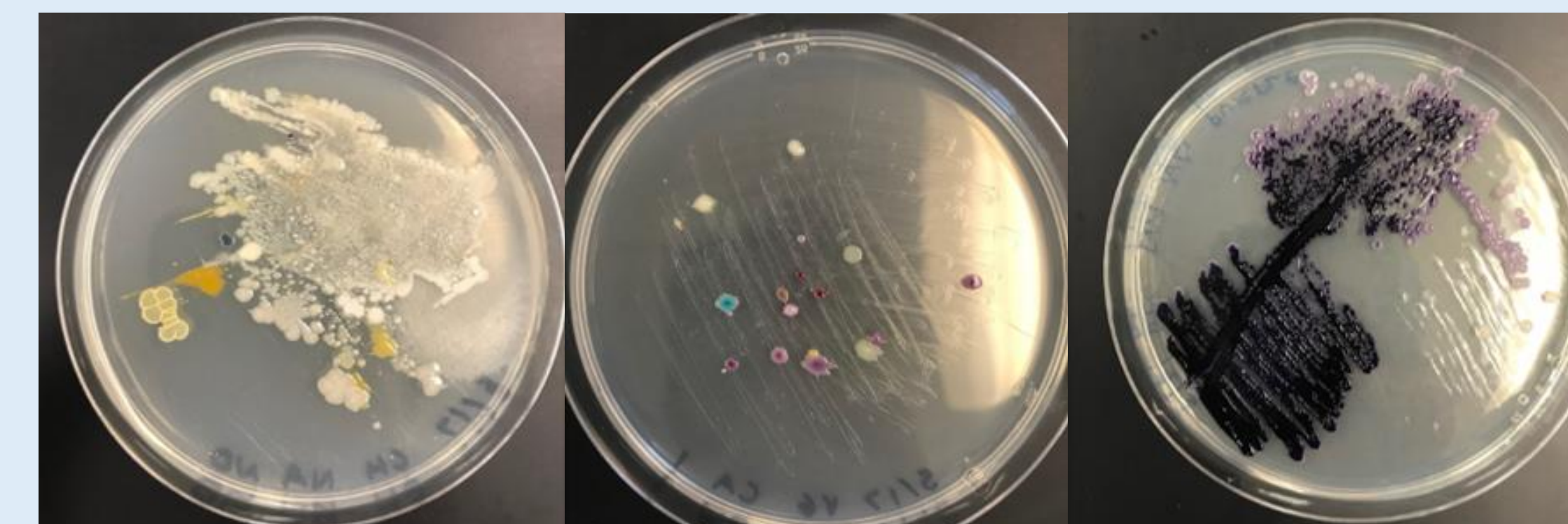


Figure 2: CA plates of Wissahickon water samples collected in Summer 2019. Photo credit: Olivia Mowery.

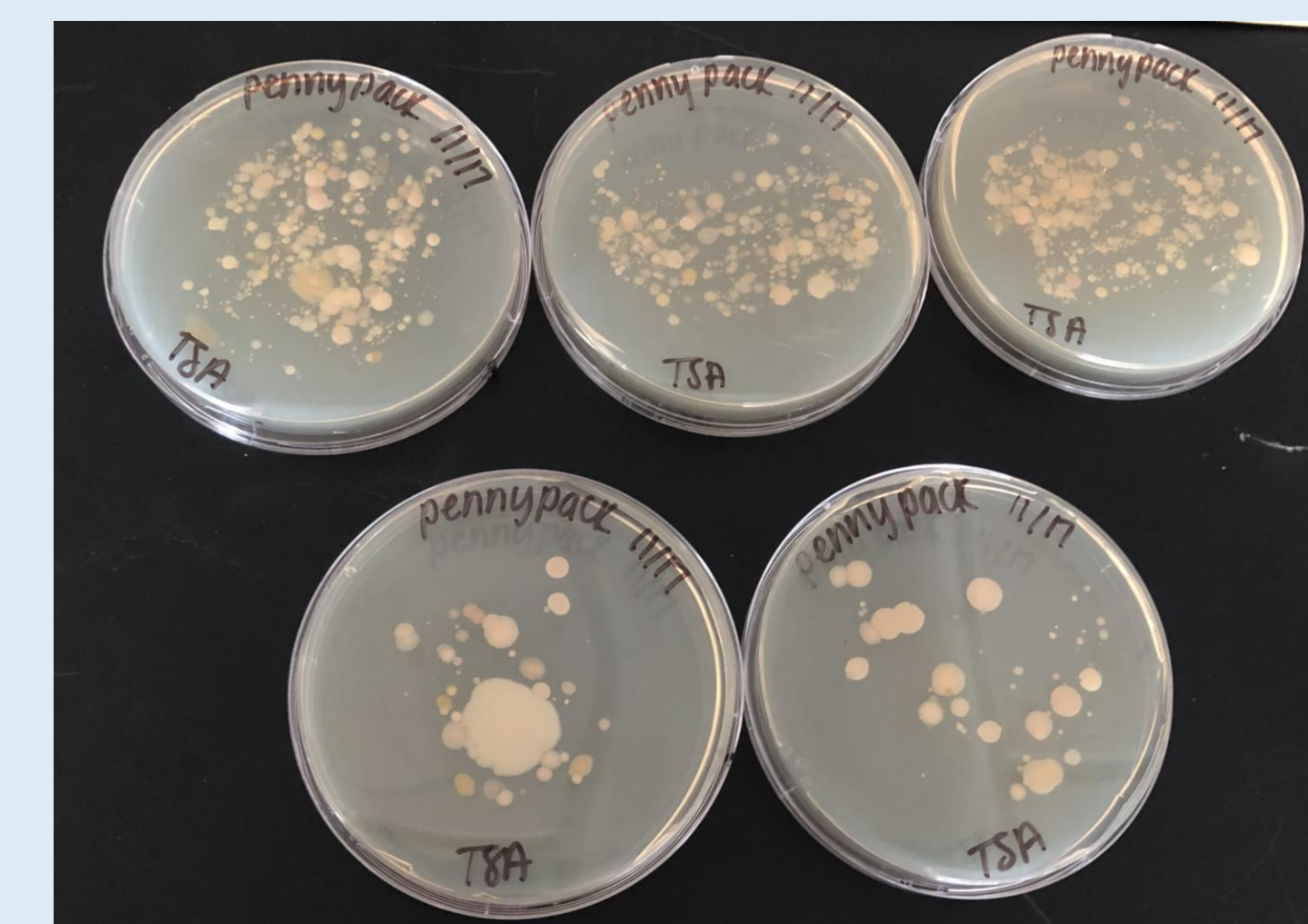


Figure 4: TSA plates of Pennypack water samples collected in Fall 2019



Figure 5: TSA plates of Wissahickon water samples collected in Fall 2019

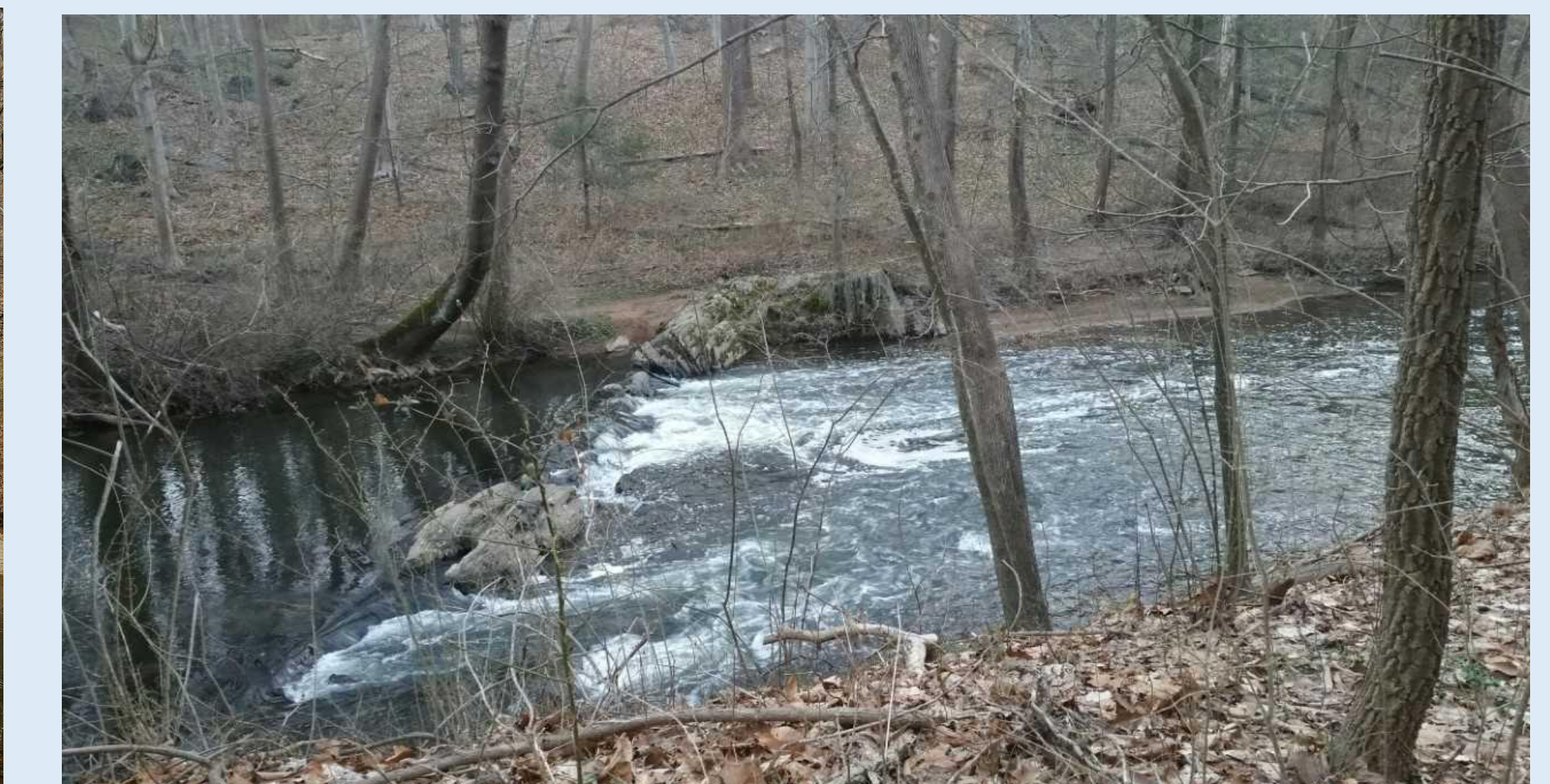


Figure 3: Images of the Pennypack Creek (left) and the Wissahickon Creek at the La Salle Penllyn BioStation (top) taken in Fall 2019. Photo credit: Dr. James Church.

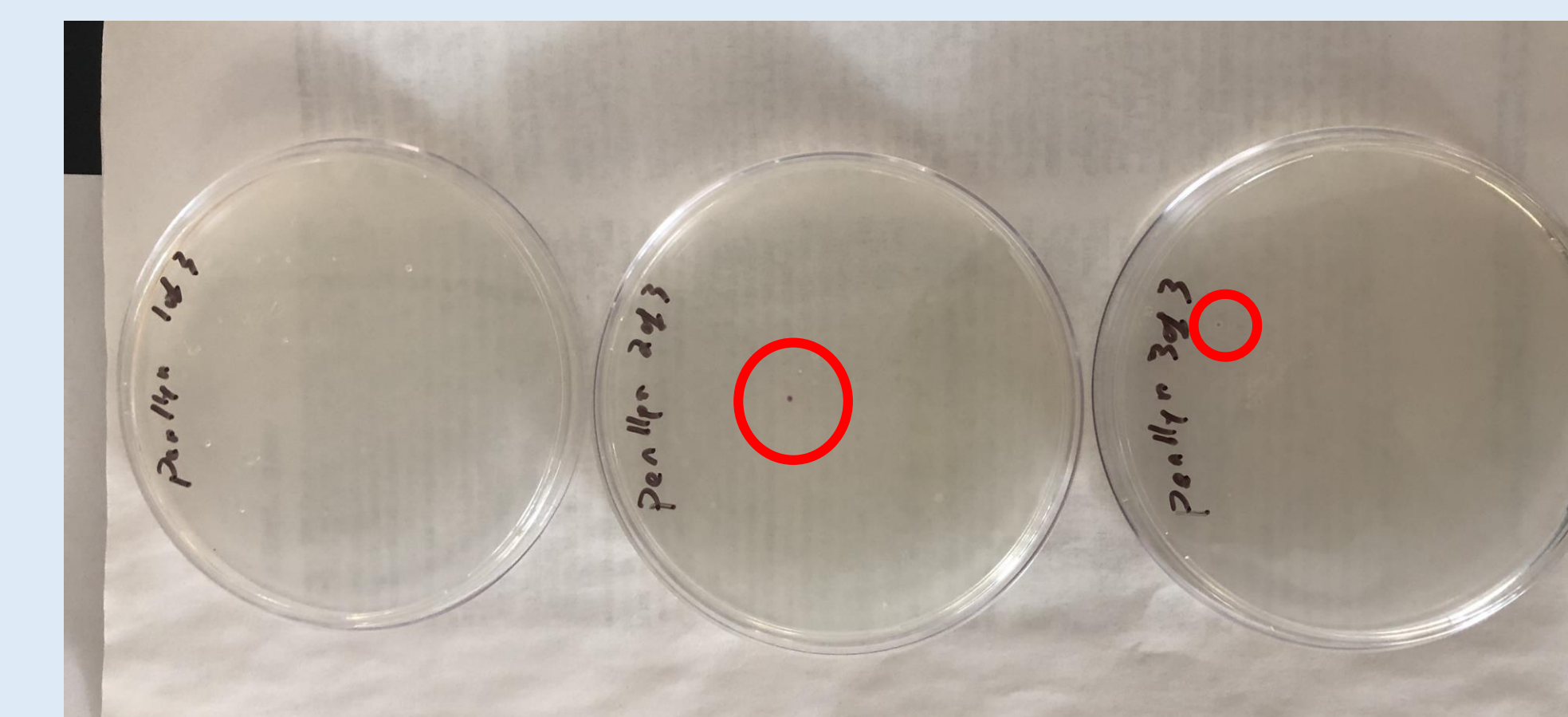


Figure 6: CA plates of Wissahickon water collected in Fall 2019. Likely colonies of *E. coli* are circled.

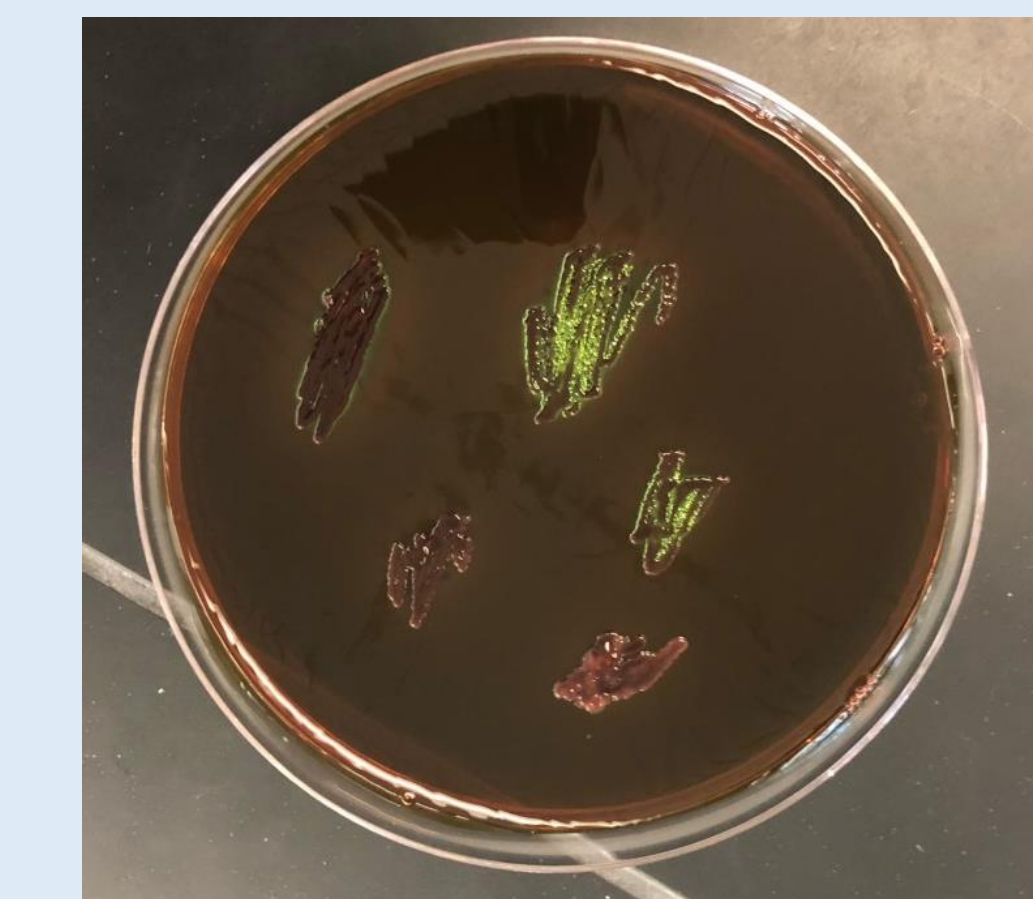


Figure 7: EMB plate of Pennypack water collected in Fall 2019. Bright green colonies are likely *E. coli*.

Urban streams in the Philadelphia area are home to microbial communities whose structures change over the course of the seasons, as evidence by plates collected during other experiments (Figs. 1 & 2). Samples collected in Summer 2019 are the most abundant and diverse (Fig. 2). Samples from both streams likely have *E. coli*, as evidenced by the purple colony in Figure 6 and the metallic green colonies in Figure 7. Samples collected from the Wissahickon in Fall 2019 have a greater abundance of microbes than the sample collected from the Pennypack (Figs. 4 & 5). The lower diversity of microbes and the presence of *E. coli* in the Pennypack may be evidence of urban stream syndrome. It is likely, however, that both creeks are polluted, as the Wissahickon sample was collected near the North Wales Wastewater Treatment Facility and the Pennypack sample was collected near the Friends of Fox Chase Farm. These locations probably discharge fecal matter into the environment.

Future Directions

- ❖ Bacteria suspected to be *E. coli* will be genetically sequenced to identify them.
- ❖ Populations of *E. coli* isolated from urban streams could be studied using population genetics to assess genetic differentiation of relatively isolated microbial populations.
 - ❖ Assess variations due to microhabitats.
 - ❖ Evaluate the structure and diversity of communities as they relate to the environment.
- ❖ In the long term, this research can be used to infer the evolutionary history of microbial species.

Literature Cited

1. GNIS Detail - Pennypack Creek. U.S. Geological Survey, https://geonames.usgs.gov/apex/?p=138:3:0::NO::P3_FID,P3_TITLE:1193104,Pennypack Creek.
2. GNIS Detail - Wissahickon Creek. U.S. Geological Survey, https://geonames.usgs.gov/apex/?p=gnispq:3:0::NO::P3_FID:1191626.
3. Jang, J. "Environmental Escherichia Coli: Ecology and Public Health Implications—a Review." *Journal of Applied Microbiology*, vol. 123, no. 3, 6 Apr. 2017.
4. Kiersztyn, Bartosz, et al. "Structural and Functional Microbial Diversity along a Eutrophication Gradient of Interconnected Lakes Undergoing Anthropopressure." *Scientific Reports*, vol. 9, no. 11144, 31 July 2019. *Nature*, doi:10.1038/s41598-019-47577-8.
5. Rivkin, L. Ruth, et al. "A Roadmap for Urban Evolutionary Ecology." *Evolutionary Application*, vol. 12, no. 3, 14 Dec. 2018, pp. 384–398.
6. "Urban Streams and Runoff." *Urban Natural Resources Stewardship*, United States Department of Agriculture - Forest Service, https://www.nrs.fs.fed.us/urban/water_air_quality/urban_streams/.
7. Walsh, Christopher J., et al. "The Urban Stream Syndrome: Current Knowledge and the Search for a Cure." *Journal of the North American Benthological Society*, vol. 24, no. 3, 2005, pp. 706–723., doi:10.1899/04-028.1.